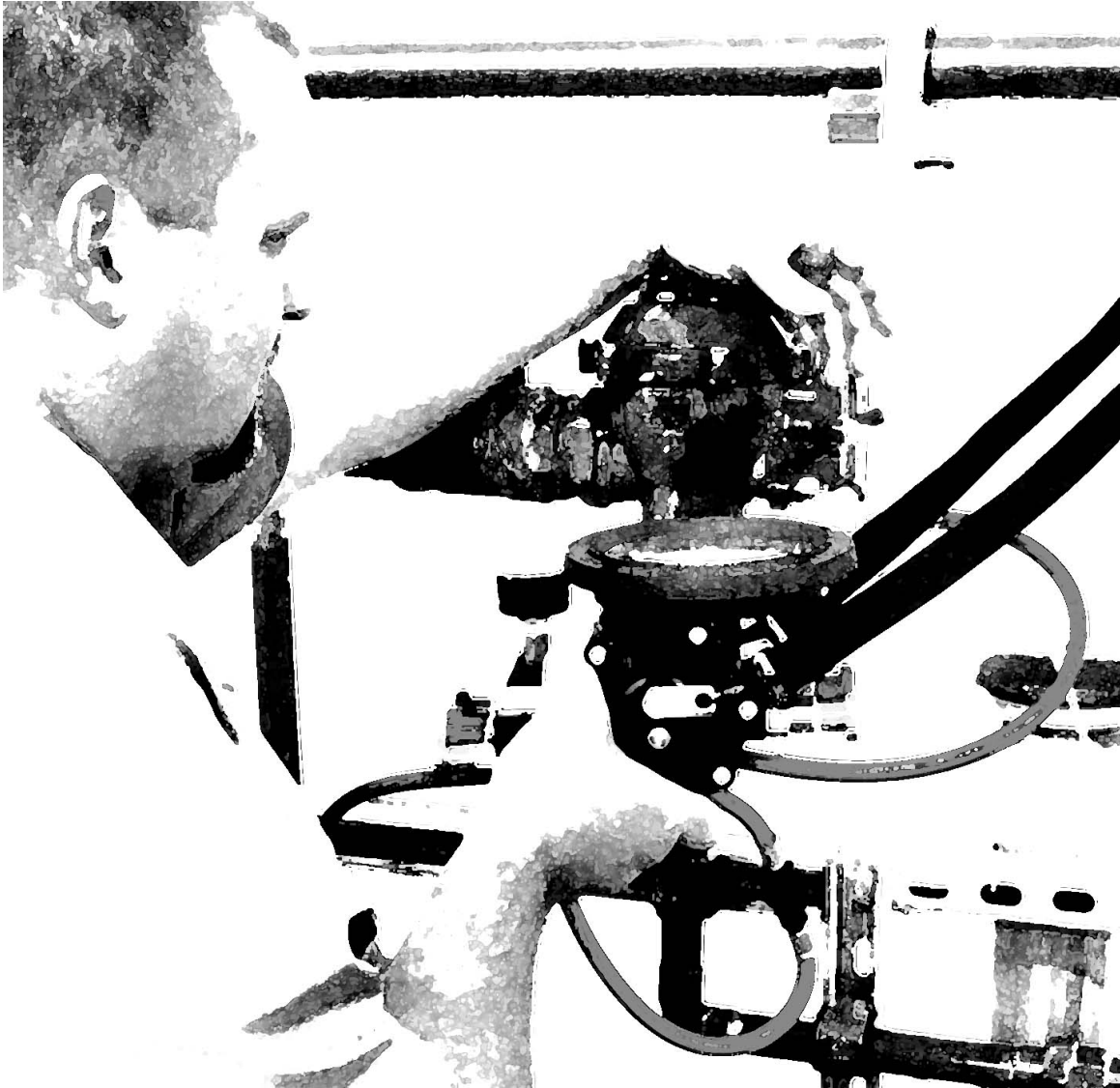


BACKFLOW PREVENTION ASSEMBLY TESTING MANUAL



Los Angeles County Department of Public Health
Environmental Protection
Cross-Connection and Water Pollution Control Program

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TESTING TECHNIQUES REQUIRED FOR BACKFLOW CERTIFICATION IN LOS ANGELES COUNTY

GENERAL INFORMATION

Backflow prevention assemblies are to be tested according to the following instructions, and the results reported on test and maintenance forms furnished by the Health Department. Any part of the check valve, relief valve or air inlet valve found defective must be repaired or replaced immediately, and a retest must show the assembly is operating properly. Leaking shutoff valves which prevent a test from being made must be repaired.

DIFFERENTIAL PRESSURE GAUGE - dial range, 0-15 psi, 0.2 psi intervals. The following is a list of several gauges reviewed by the University of Southern California Foundation of Cross-Connection Control and Hydraulic Research and found to be acceptable as testing equipment for backflow prevention devices and meet general guidelines found in Section 9 of their 9th Edition of the Manual of Cross-Connection Control for testing equipment.

Apollo Valves/Conbraco Industries, Inc.	Febco	Model TK845-5
Model 40-200-TKU,		
Model 40-200-TK5U	Meriam Instrument	Model 1124
Astra	Mid-West	Model 830
		Model 835
Cameron		Model 845-2
(Formerly Prime Measurement, ITT Barton)		Model 845-3
Measurement Systems Division		Model 845-5
Model 226		
Model 227		
Model 246	Watts	Model TKDR
Model 247		Model TKDP
Model 226C		Model TK99D
Model 227C		
Model 246C	Wilkins Regulator Co.	Model TG-3
Model 247C		Model TG-5
Danfoss Flomatic Corporation		
Model TK1		
Duke		
Model 75		
Model 75B		
Model 100		
Model 1000		
Model EZ900		

REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTERS

Reduced Pressure Principle Backflow Preventers shall be tested by utilizing an acceptable differential pressure gauge.

DOUBLE CHECK VALVE ASSEMBLIES

Double Check Valve Assemblies shall be tested at one psi in the direction of flow by:

- a. Utilizing a column of water no less than 27 ¾" above the downstream reference point tube on the inlet side of each check valve with the downstream side at atmospheric pressure, or,
- b. Utilizing an approved differential pressure gauge with the high side of the gauge connected to the inlet side of each check valve, the gauge held at the top of the downstream reference point tube and the downstream side of the check at atmospheric pressure.

Approved type check valves used in backflow assemblies are required by design specifications to have a mechanical closing load of at least one pound per square inch of area. This means that the check valve is held shut by a spring or a weight until enough water pressure is built up in the normal direction of flow to overcome this mechanical load. The purpose is to have a check valve that will be tightly closed when there is no water flow.

We can use this design fact to test check valves with the pressure developed by a short column of water located before the check valves of single or double check valve pressure vacuum breakers and double check valve assemblies.

PRESSURE TYPE VACUUM BREAKERS

Air inlets of pressure type vacuum breakers shall be tested for opening loading of no less than 1.0 psi by:

- a. Utilizing a column of water no less than 27 $\frac{3}{4}$ " above the centerline of the air inlet valve seat and connected between the preceding check valve and air inlet valve with the pressure below the air inlet valve relieved, or,
- b. Utilizing an approved differential pressure gauge with the high side connected between the preceding check valve and the air inlet valve and the gauge held at the centerline of the air inlet valve seat with the pressure below the air inlet valve relieved.

Check valves of pressure type vacuum breakers shall be tested at one psi in the direction of flow utilizing procedures described under DOUBLE CHECK VALVE ASSEMBLIES.

NOTE: While the use of water columns (tubes) for field test reporting purpose has been eliminated, testers will still be required to demonstrate proficiency in tube testing of double check valve assemblies and pressure type vacuum breakers at the time of certification and recertification. Tube testing is a valuable technique for confirming differential pressure gauge readings as well as checking gauge accuracy.

SPILL-RESISTANT PRESSURE VACUUM BREAKERS

Spill-resistant pressure vacuum breakers shall be tested by utilizing an acceptable differential pressure gauge.

CONCEPTS OF BACKFLOW PREVENTION ASSEMBLY TESTING

The following outline is based upon the extensive cross-connection control program and lengthy operational experience of the County of Los Angeles Department of Public Health.

Readers are presumed to be familiar with backflow prevention assemblies and various testing techniques. Little mention is made, therefore, of such procedures as blowing out test cocks, isolating units for test or connecting test equipment.

In addition, particular reference is made to the differential pressure gauge since it has been found suitable for all backflow prevention assembly testing.

Further, field testing of check valves in the direction of flow is the selected technique since it is in conformance with design specifications and laboratory field testing. It excels in ease of performance and is problem-free. Testing in reverse of flow has, therefore, been rejected.

1. Trouble-shooting is an integral part of testing and necessary to avoid unjustified assembly replacement or repair.
2. Backflow prevention assemblies must be tested under static (no flow) conditions.
 - a. Compensating for No. 1 Shutoff Valve leaks on double check valve assemblies, pressure vacuum breakers and spill resistant vacuum breakers:
 - **Gauge** – Connect the reference tube to the test cock downstream from the check valve being tested and fill with water. With the gauge connected to the test cock upstream of the check valve being tested, pressurize the gauge and close the number one shutoff valve. Open the downstream test cock and make further adjustments to the bleed valve until there is a slight drip or meniscus on the reference tube. Note and record the gauge reading.
 - **Water Column** – Connect the reference tube to the test cock downstream from the check valve being tested and fill with water. Close test cock. Connect water column to the upstream test cock and fill with water to at least 27 ¾" above the reference tube. Close test cock. Close upstream shutoff valve. Open the downstream test cock. Open the upstream test cock. Wait till stabilized. Make adjustments to the bleed valve until there is a slight drip or meniscus on the reference tube. The check valve is holding tight if it holds the one pound water column.
 - **Reference Tube** - Connect the reference tube to the test cock downstream from the check valve being tested. Usually a small tube attached to a christmas tree/bleed apparatus to evaluate the integrity of the water shut off valves. The reference tube/bleed valve combination allows for a meniscus of water to be established in the testing of check valves and shut off valves.
3. The differential pressure gauge, used as a low pressure gauge (high side only), in testing pressure vacuum breakers and double check valve assemblies can be applied to:
 - a. Detect leaks by reducing internal assembly pressure below maximum:
 - **Stable Gauge** - No leaks
 - **Rising Gauge** - Indicative of inlet shut-off valve, leak. Compensate for leak through a bleed valve, controlling flow to stabilize gauge. Exception: Leaking outlet shut-off valve with back pressure; repair or replace valve.
 - **Falling Gauge** - Indicative of leaking fittings, connections or outlet shut-off valve leak. May or may not interfere with testing.
 - b. Determine pressure vacuum breaker air inlet opening values by reducing internal assembly pressure and observing gauge reading when inlet opens. Minimum acceptable reading: 1.0 psi
 - c. Determine check valve closing values in pressure type vacuum breakers and double check valve assemblies testing in the direction of flow by reducing the pressure downstream of any

check valve to atmospheric and observing the upstream pressure at which the check valve closes. Minimum acceptable value: 1.0 psi.

Note: Accurate gauge readings of check valves are dependent on a solid downstream reference point. If the downstream test cock is at the highest point on the valve body, this can be the reference point where the gauge is held. However, if the downstream test cock is below the top of the valve body, then a piece of pipe or tubing (Reference Tube) must be attached to the downstream test cock so that it rises at least to the top of the valve body. If a tube is attached to the downstream test cock, then the gauge must be held at the same height as the water in the reference tube.

- d. When compensating for #1 shutoff valve leaks, make a final adjustment of the bleed valve to create a meniscus or slight drip from the downstream reference tube, with the downstream test cock open. The reading on the gauge should be greater than or equal to 1.0 psi and recorded as the static pressure across the check.
 4. A 27 3/4" water column (1.0 psi) can be used to establish whether minimum air inlet opening or check valve closing values is attained.
 5. A water column can be used to verify gauge accuracy.
 6. The second check of a reduced pressure principle assembly can be tested as above; however, to avoid disturbing shut-off valve debris and possibly fouling the assembly, testing in reverse is preferable to testing in the direction of flow.
 7. In testing a reduced pressure principle assembly, a tester must recognize that a relief valve discharge following closing of the downstream shut-off valve is caused by pressure equalization across a leaking first check valve. Pressure spikes may be caused from closing downstream resilient shutoff valves causing the second check disk to compress inducing the relief valve to discharge or if the second check was leaking, the pressure spike will make the relief valve discharge.
 8. In testing a reduced pressure principle assembly, a tester must be able to distinguish between:
 - a. A leaking downstream shut-off valve which prevents relief valve from opening and an inoperable relief valve: A zero gauge may be indicative of a defective relief valve sensing line. Flow through may be stopped using a by-pass from inlet to outlet test cocks or closing the inlet shut-off valve.
 - b. A relief valve continuous discharge caused by: a defective first check valve under a no flow condition; a defective second check valve under back pressure; or, a defective relief valve. With gauge disconnected:
 - If closing the inlet shut-off valve causes the relief valve to fully dump, the first check valve leaks.
 - If closing the inlet shut-off valve produces no change in discharge, and opening testcocks in 4,3,2 order results in continuous flow at TC4 and TC3, the second check valve is leaking under back pressure; if flow occurs at TC2, either the first check valve leaks in reverse and/or the inlet shut-off valve leaks; if no flow occurs at TC4 and TC2, the relief valve is leaking.
 9. Achievement and maintenance of tester competency is a composite of initial instruction, certification followed by review of reporting and reinforcement, and reexamination/recertification at least every two years.
-

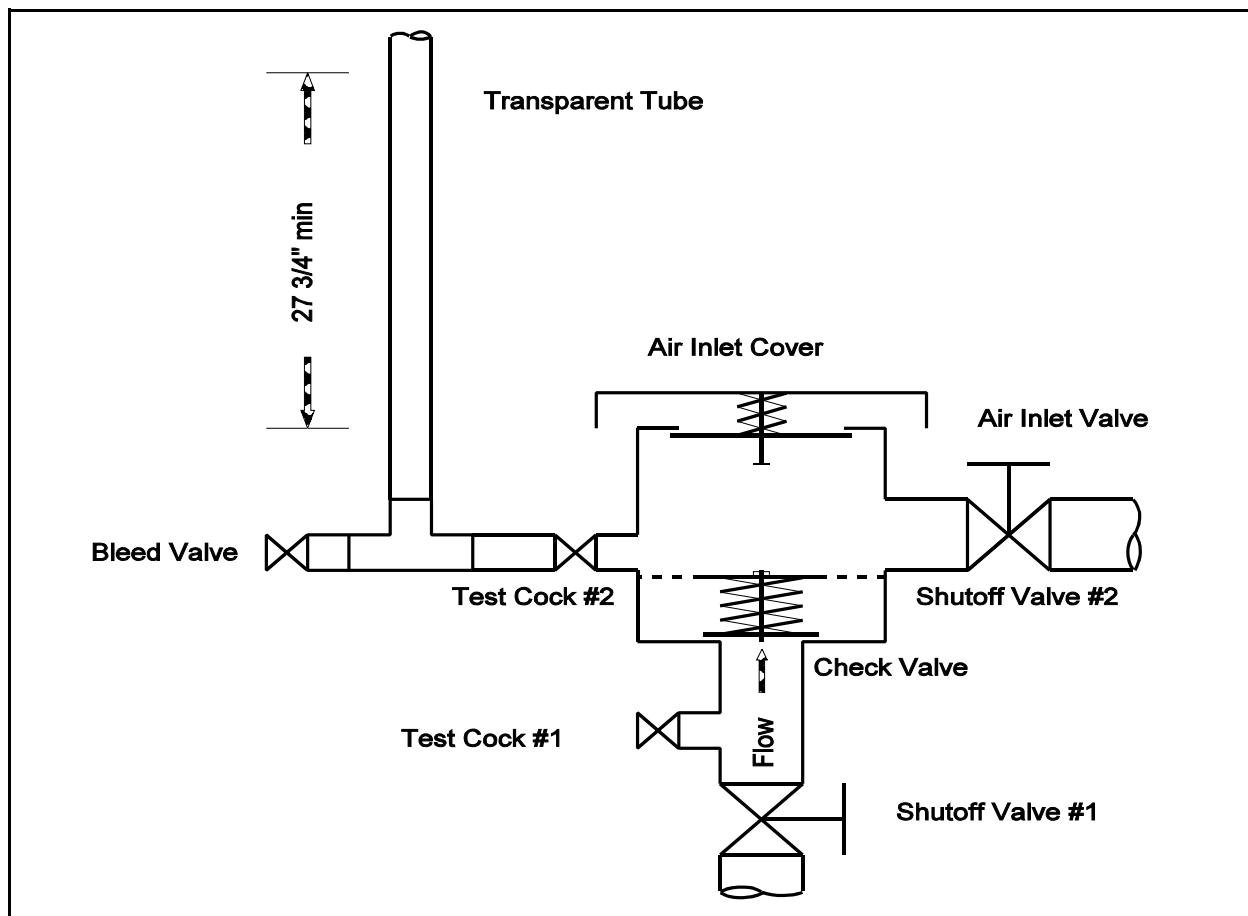


Figure 1
Tube and bleed valve connected for air inlet test

SINGLE CHECK TYPE PRESSURE VACUUM BREAKER TUBE TEST PROCEDURE

PVB Test Procedure - Part A: Air Inlet Opening Point

Materials required for test equipment:

1. Transparent tube approximately 3/4" diameter
2. Bleed valve
3. Tee, pipe nipples, fittings, etc., to assemble as shown.

Purpose: To determine the air inlet opening pressure.

Requirement: The air inlet valve must open when the water pressure in the body is at least one psi above atmospheric pressure, and the air inlet valve must be fully open with water drained from body.

Procedure: Refer to Figure #1

- a. Remove cover over air inlet to permit observation of opening of the air inlet valve and allow location of air inlet seat to obtain point of measurement.
 - b. Attach tube and bleed valve (closed) at test cock #2 (see drawing). Top of tube must be at least 27 ³/₄ inches above air inlet valve seat.
 - c. Open test cock #2 to fill tube with water, then close.
 - d. Close shutoff valve #2, then valve #1. Open test cock #2. Air inlet valve may open at this point. If it does, the air inlet valve is operating satisfactorily.
 - e. If air inlet valve is not open, carefully open bleed valve and note water level in tube when air inlet opens. If the water column is less than 27 ³/₄ inches above the air inlet seat or air inlet does not fully open with all water drained from tube, the air inlet is defective and this should be noted on the report form.
 - f. Close test cock #2 and remove tube and bleed valve.
-

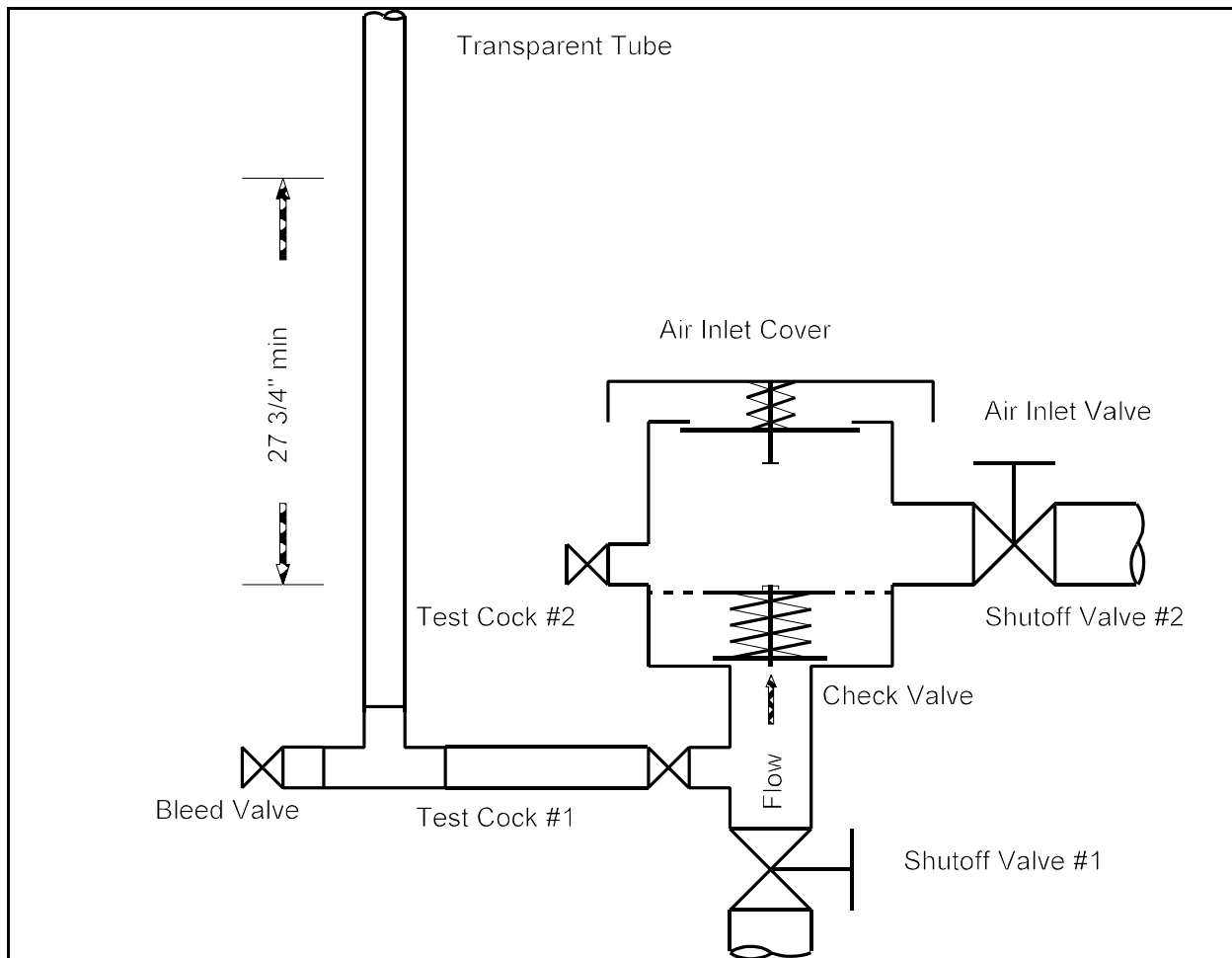


Figure 2
Tube and bleed valve connected for check valve test

PVB Test Procedure - Part B: Check Valve Operation

Purpose: To test check valve for tightness in direction of normal water flow.

Requirement: The check valve shall not allow water flow in the normal direction of water flow when the inlet pressure is 1.0 psi and the outlet pressure is atmospheric.

Procedure: **Refer to Figure #2**

- Install tube and bleed valve (closed) at test cock #1.
- Open shutoff valve #1.
- Slowly open test cock #1 and fill tube with water to 27 3/4 inches above test cock #2.
- Close shutoff valve #1, reopen test cock #1 and check for gate valve leak (compensate with bleed valve if necessary). Open test cock #2. If water remains in tube at 27 3/4 inches the check valve is operating satisfactorily.
- If water drops in tube below 27 3/4 inches, check valve has leaked and would require repair.
- Close test cock #1 and #2. Remove tube and bleed valve, replace air inlet cover, and open shutoff valves #1 and #2.

TWO CHECK TYPE PRESSURE TYPE VACUUM BREAKER TUBE TEST PROCEDURE

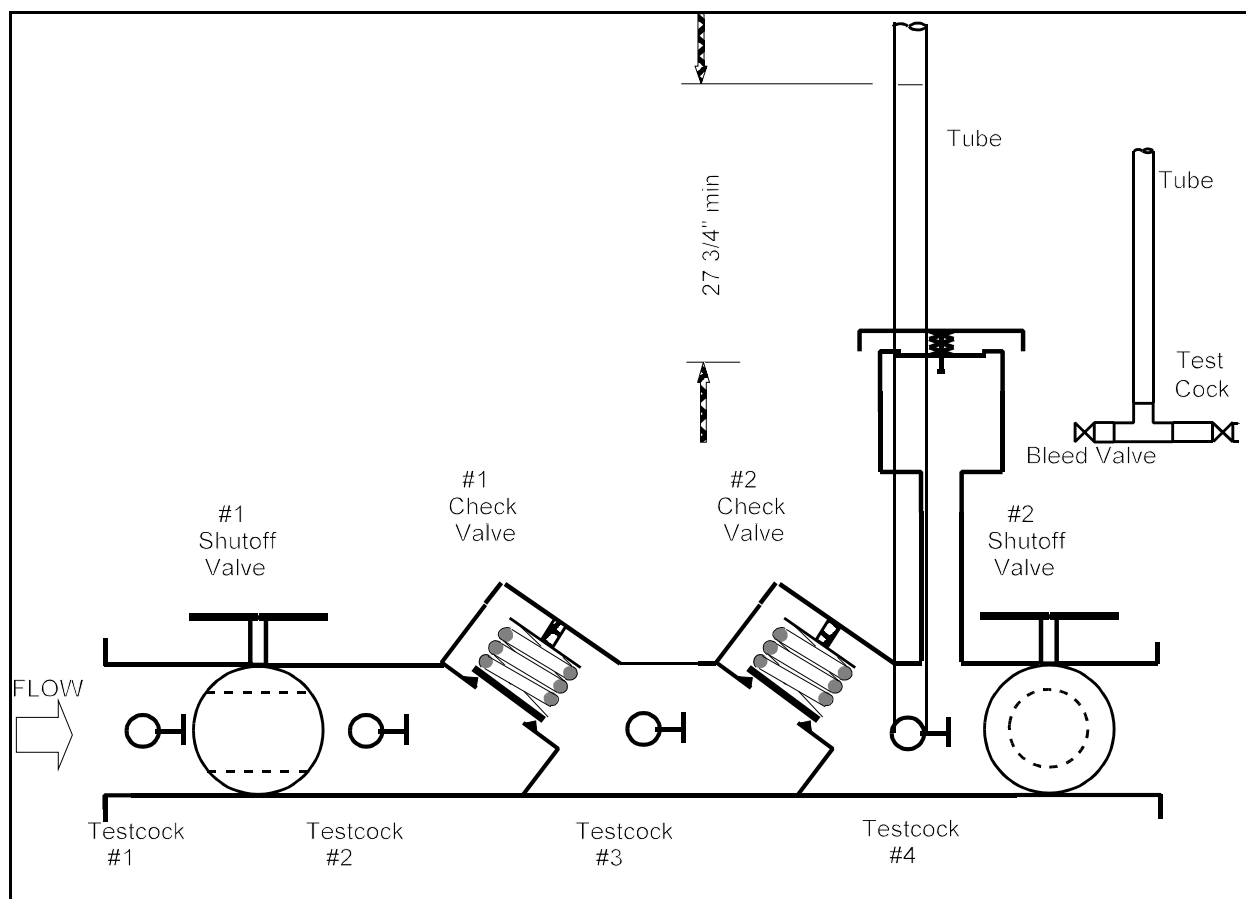


Figure 3
Tube and bleed valve connected for air inlet test

Test Procedure - Part A: Air Inlet Operation

Material required for test equipment:

1. Transparent tube approximately $\frac{3}{4}$ " diameter.
2. Bleed valve.
3. Tee, pipe nipples, etc. to assemble as shown.

Purpose: To obtain the opening pressure differential of the air inlet valve.

Requirement: The air inlet valve must open when the water pressure in the body is at least 1.0 psi above atmospheric pressure, and the air inlet valve must be fully open with water drained from body.

Procedure: **Refer to Figure # 3**

- a. Remove cover over air inlet. This will permit observation of opening of the air inlet valve and allow location of air inlet seat to obtain point of measurement.

- b. Attach tube and bleed valve (closed) at test cock #4 (see drawing). Top of tube must be at least 27 $\frac{3}{4}$ inches above the air inlet valve seat.
 - c. Open test cock #4 to fill tube with water, then close.
 - d. Close shutoff valve #2, then valve #1. Open test cock #4. Air inlet valve may open at this point. If it does, the air inlet valve is operating satisfactorily.
 - e. If air inlet valve is not open, carefully open bleed valve and note water level in tube when air inlet opens. If the water column is less than 27 $\frac{3}{4}$ inches above the air inlet seat or the air inlet does not open with all water drained from tube, the air inlet is defective and this should be noted on the report form.
 - f. Close test cock #4 and remove tube and bleed valve. Replace cover to air inlet.
-

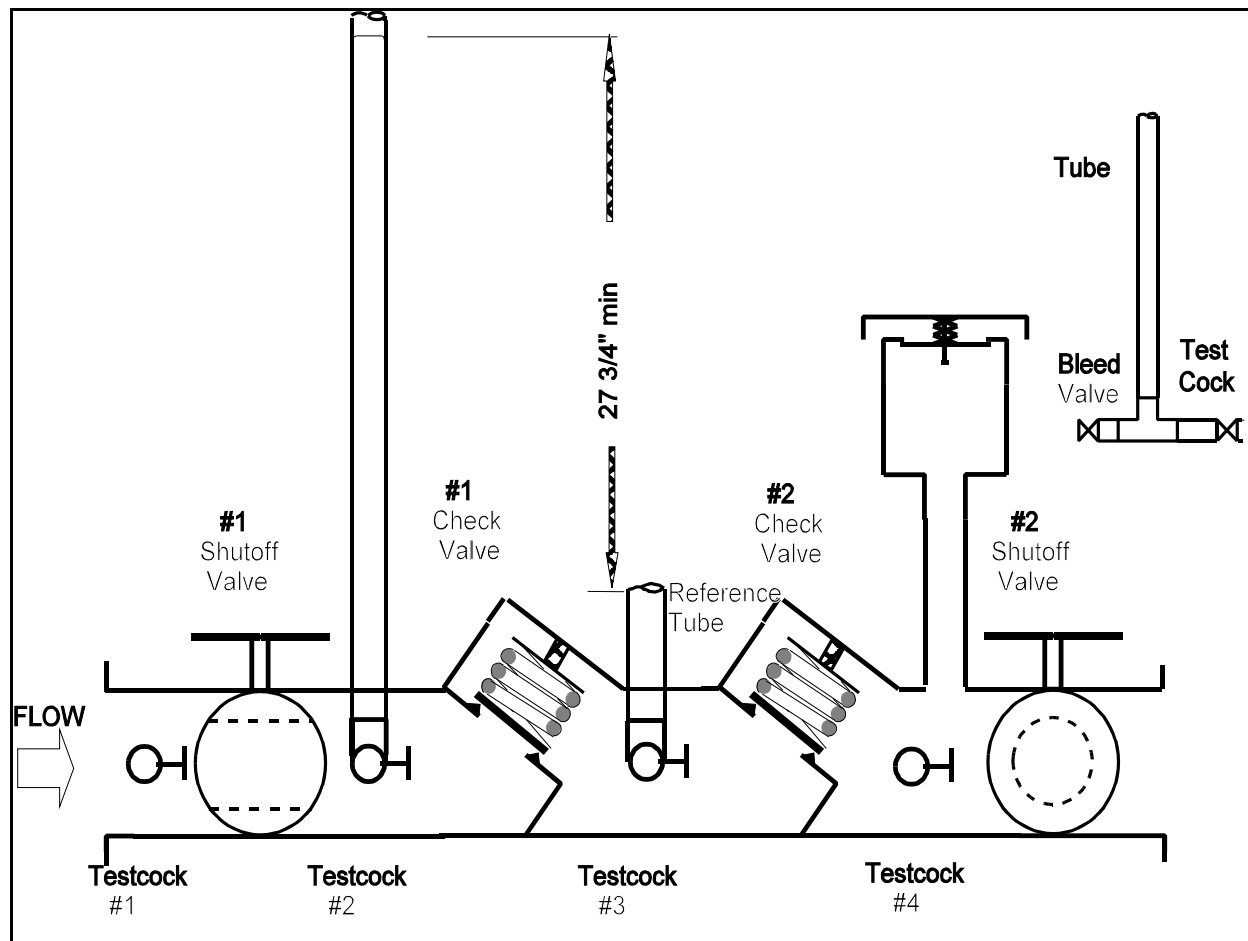


Figure 4
Tube and bleed valve connection for check valve #1

Test Procedure - Part B: Check Valve Operation

Purpose: To test check valves for tightness in direction of normal water flow.

Requirement: The check valve shall not allow water flow in the normal direction of water flow when the inlet pressure is 1.0 psi and the outlet pressure is atmospheric.

Procedure: **Testing Check Valve #1 (refer to figure #4)**

- a. Install tube and bleed valve (closed) at test cock #2.
- b. Open shutoff valve #1.
- c. Slowly open test cock #2 and fill tube with water to 27 $\frac{3}{4}$ inches above the downstream reference point. Close testcock #2. Open test cock #3 and fill reference tube with water, and close test cock #3. Close shutoff valve #1.
- d. Open test cock #3. Open testcock #2. Check for shutoff valve leak at the reference tube (compensate with bleed valve).
- e. If the water column in the tube remains at a height of 27 $\frac{3}{4}$ inches (or more) the check valve shall be considered as "closed tight." If the water in the tube drops below 27 $\frac{3}{4}$ inches, or drains away, the check valve shall be considered as "leaked," and requires repair.
- f. Close test cocks #2 and #3.

Testing Check Valve #2

- a. Move tube to test cock #3. Move reference tube to test cock #4.
 - b. Open shutoff valve #1. Carefully open test cock #3 to fill tube as in step "c" above.
 - c. Evaluate the test results as described in step "c" above.
 - d. Close all test cocks, remove tube, and open both shutoff valves to return unit to service.
-

DOUBLE CHECK VALVE ASSEMBLIES TUBE TEST PROCEDURE

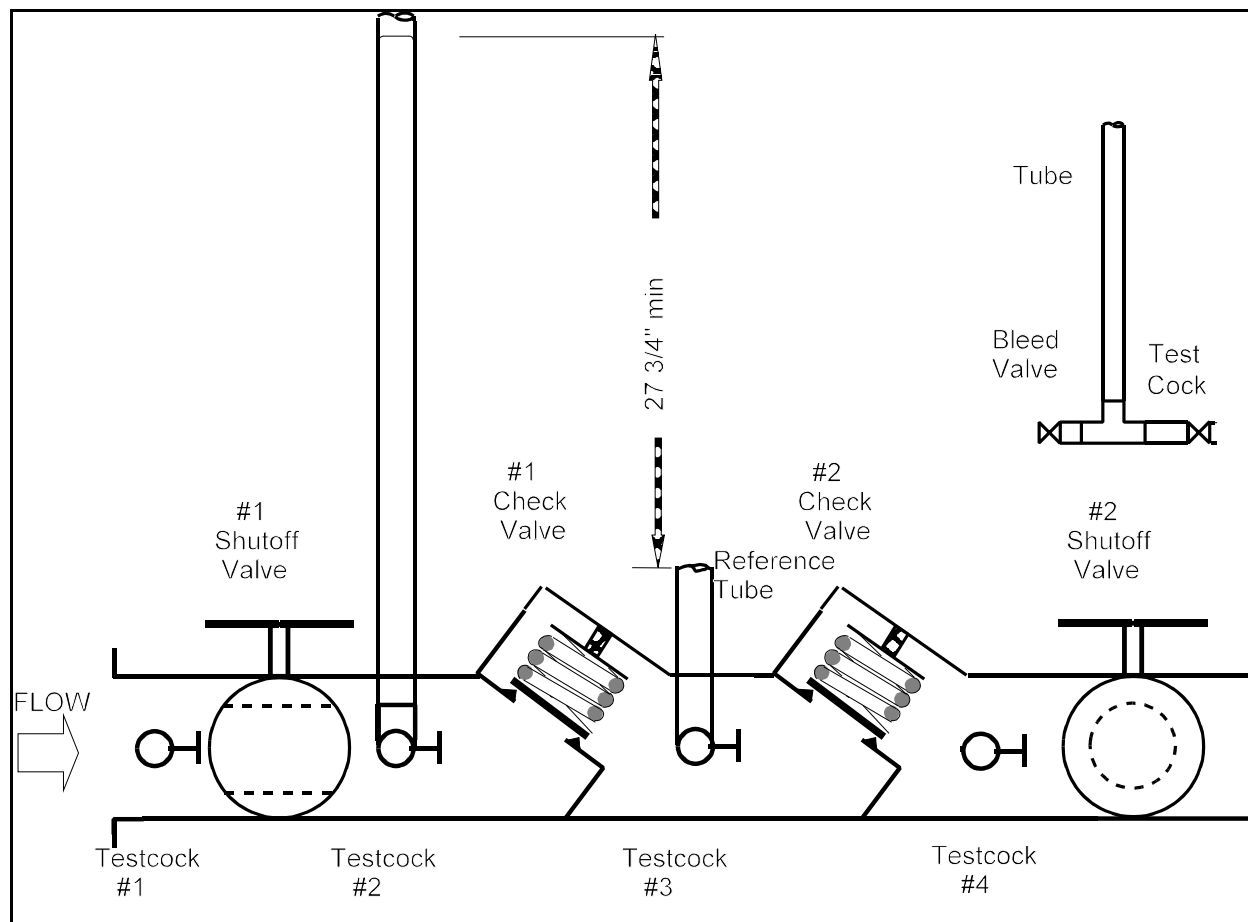


Figure 5
Tube and bleed valve connection for check valve test.

Test Procedure: Check Valve Operation

Purpose: To test check valves for tightness in direction of normal water flow.

Requirement: The check valve shall not allow water flow in the normal direction of water flow when the inlet pressure is 1.0 psi and the outlet pressure is atmospheric.

Procedure: **Testing Check Valve #1 (refer to figure #5)**

- Install 27 3/4 inches tube and bleed valve (closed) at test cock #2. Install reference tube at test cock #3.
- Open shutoff valve #1.
- Slowly open test cock #2 and fill tube with water to 27 3/4 inches above the downstream reference point. Close test cock #2. Open testcock #3 and fill reference tube with water, and close test cock #3. Close shutoff valve #1.
- Open testcock #3. Open test cock #2. Check for shutoff valve leak at the reference tube (compensate with bleed valve).

- e. If the water column in the tube remains at a height of 27 $\frac{3}{4}$ inches (or more) the check valve shall be considered as "closed tight." If the water in the tube drops below 27 $\frac{3}{4}$ inches, or drains away, the check valve shall be considered as "leaked," and requires repair.
 - f. Close test cocks #2 and #3.
-

Testing Check Valve #2

- a. Move tube to test cock #3 and reference tube to test cock #4.
 - b. Open shutoff valve #1. Carefully open test cock #3 to fill tube and test cock #4 to fill reference tube as in step "c" above.
 - c. Evaluate the test results as described in step "e" above.
 - d. Close all test cocks, remove tube, and open both shutoff valves to return unit to service.
-

SINGLE CHECK PRESSURE TYPE VACUUM BREAKER GAUGE TEST PROCEDURE

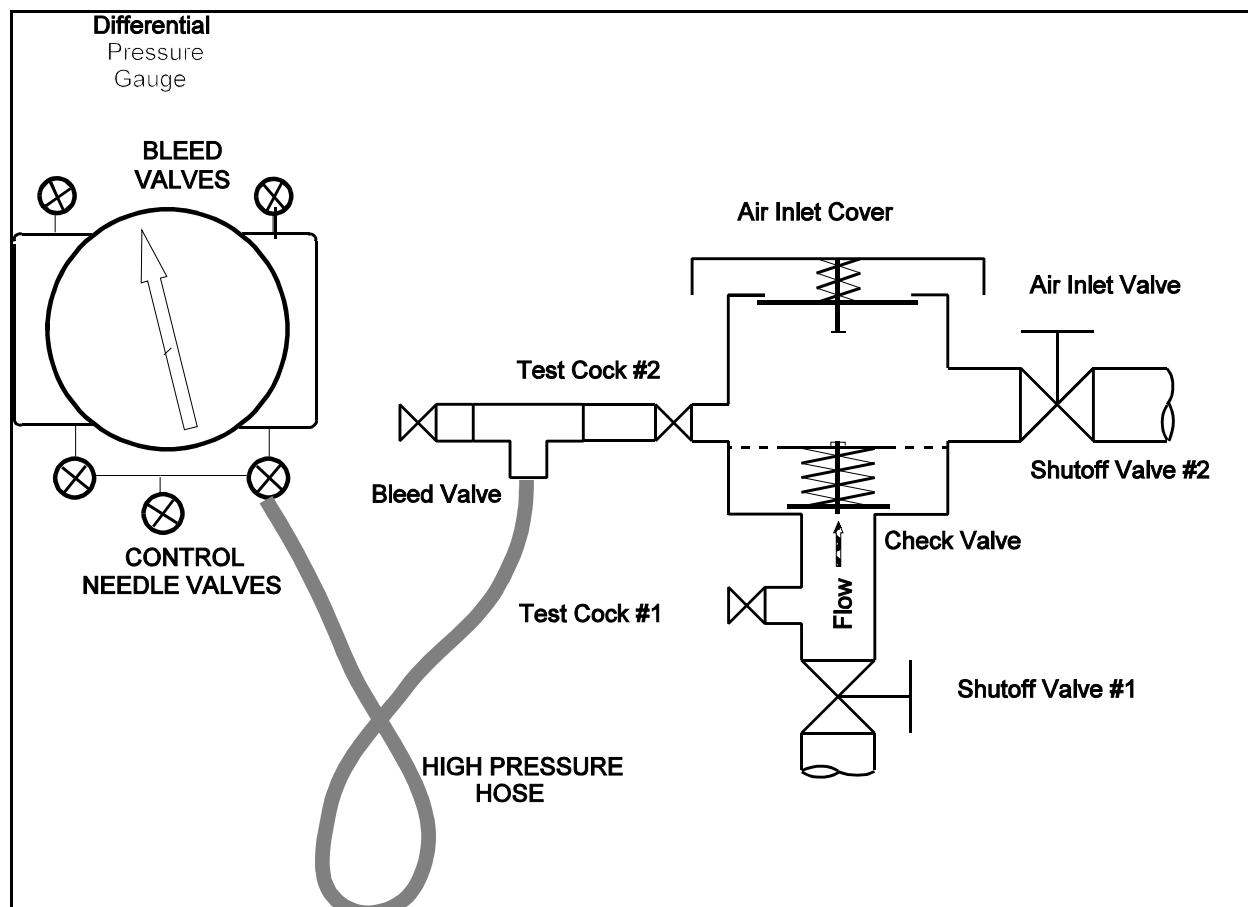


Figure 6
Gauge connection for air inlet test.

Test Procedure - Part A: Air Inlet Operation

Materials required for test equipment:

1. Approved differential pressure gauge and flexible hose.
2. Bleed valve.
3. Tee, pipe nipples, fittings, etc. to assemble as shown.

Purpose: To obtain the opening pressure differential of the air inlet valve.

Requirement: The air inlet valve must open when the water pressure in the body is at least one psi above atmospheric pressure, and the air inlet valve must be fully open with water drained from body.

Procedure: **Refer to Figure #6**

- a. Remove cover over air inlet to permit observation of opening of the air inlet valve.
- b. Attach high pressure side hose from differential pressure gauge to test cock #2.
- c. Open test cock #2 and vent air from gauge. Close vent valve.

- d. Close shutoff valve #2, then #1.
 - e. Slowly open bleed valve, holding gauge at level of air inlet seat. Note pressure on gauge when air inlet valve opens. This should be 1.0 psi or more.
 - f. Close test cock #2 and remove equipment.
 - g. Open shutoff valve #1.
-

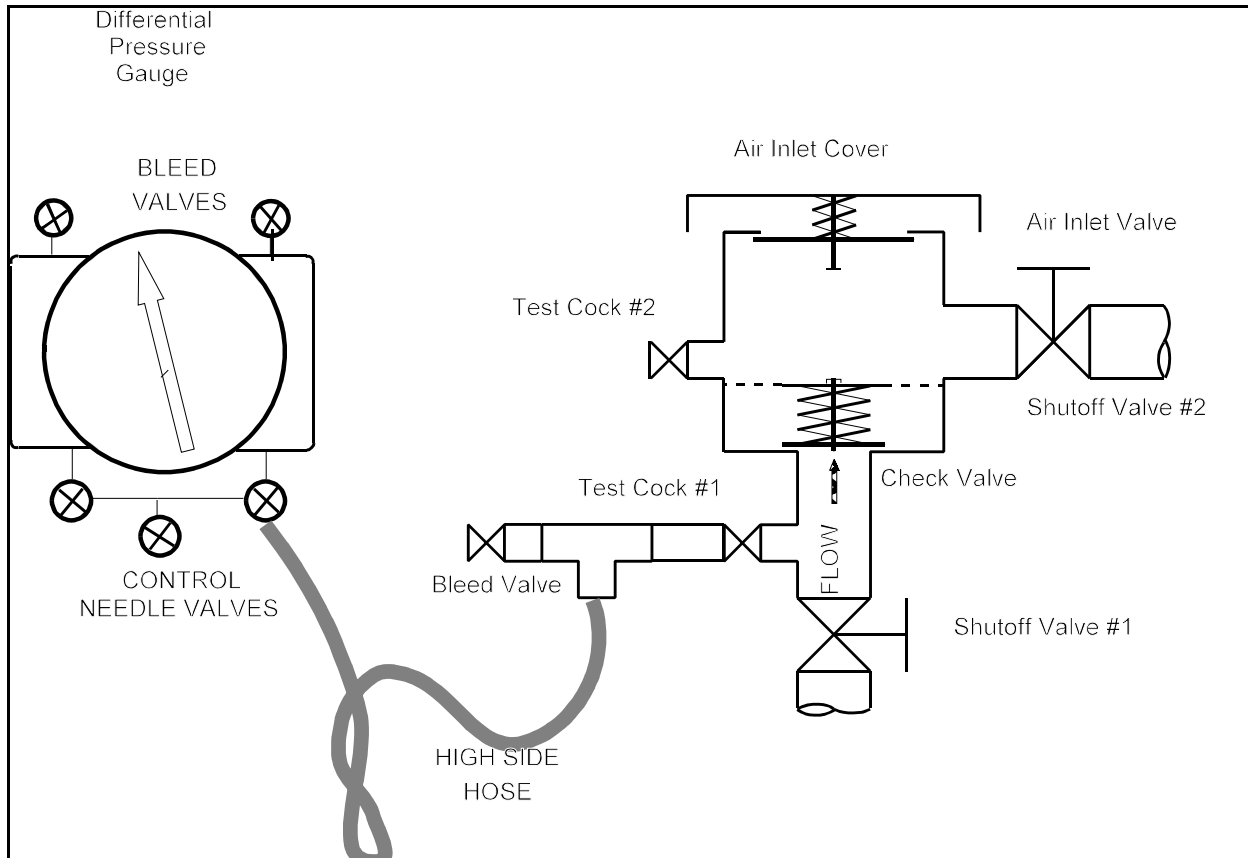


Figure 7
Gauge connection for PVB check valve.

Test Procedure - Part B

Check Valve Operation

Purpose: To test check valve for tightness in direction of normal water flow

Requirement: The check valve shall not allow water flow in normal direction of flow when the inlet pressure is 1.0 psi and the outlet pressure is atmospheric.

Procedure: Testing check valve (refer to Figure # 7)

- a. Attach high pressure side hose from differential pressure gauge to test cock #1.
- b. Open test cock #1 and vent air from gauge.
- c. Close shutoff valve #1. Bleed pressure down to 12 pounds or so and check for shutoff valve leak (needle rises). Compensate with bleed valve if necessary.
- d. Open test cock #2 slowly, holding gauge at same level as test cock #2, allowing water to drain from the body. If pressure drops below 1.0 psi, check valve is reported as leaked, and requires repair. Record gauge reading on test form if pressure holds 1.0 psi or more.
- e. Close test cocks #1 and #2, remove hose and fittings, and open shutoff valves #1 and #2. Replace air inlet cover.

SPILL-RESISTANT PRESSURE VACUUM BREAKER GAUGE TEST PROCEDURE

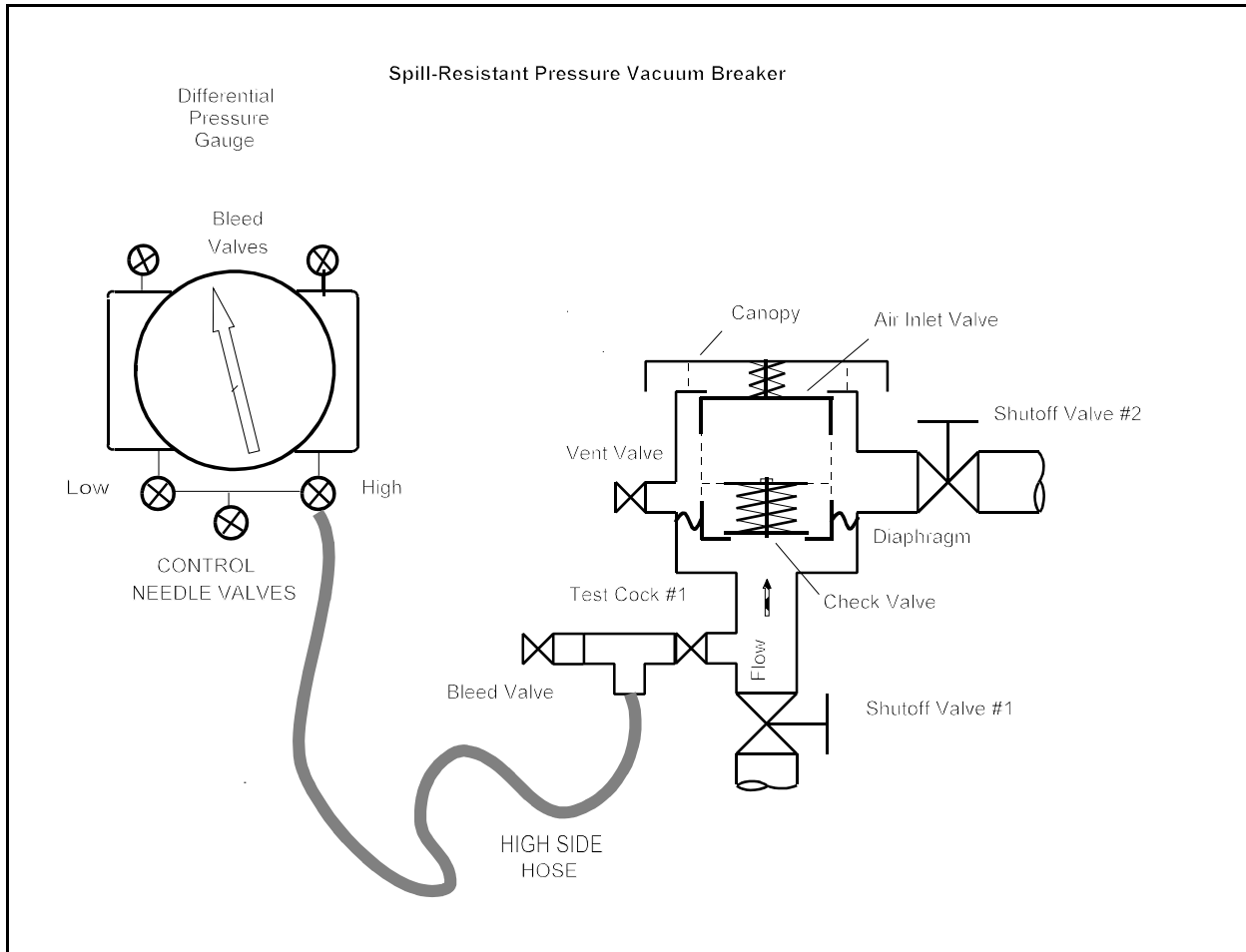


Figure 8
Gauge connection to Spill-Resistant Pressure Vacuum Breaker

Test Procedure - Part A: Air Inlet Opening Point

Purpose: To determine the air inlet opening pressure.

Requirement: The air inlet valve must open when the water pressure in the body is at least one psi above atmospheric pressure, and the air inlet shall be fully open with water drained from body.

Procedure: Refer to Figure # 8

- Remove the cover over air inlet to permit observation of the opening of the air inlet valve.
- Flush vent valve and test cock of any foreign material.
- Attach high pressure side hose from differential pressure gauge to bleed valve attached to the test cock. Open test cock and vent air from hose and gauge by opening the high side bleed valve on the gauge. While bleeding gauge fill top of air inlet with water which will make determining the opening point of the air inlet easier. Close the high side bleed valve on the gauge.

- d. Close shutoff valve No. 2, then No. 1. Check for shutoff valve leak by bleeding the bleed valve attached to test cock so the gauge drops and stabilizes at 8-10 psi.
 - e. Open vent valve on vacuum breaker to lower the outlet pressure to atmospheric. Observe any change on the gauge and/or movement of the water on top of the air inlet and record value if the air inlet opens at this point.
 - f. Slowly open the high side bleed valve attached to the gauge about 1/4 turn and record the reading at which the air inlet opens if it didn't open when the vent valve was opened. The reading for the air inlet opening should be 1.0 psi or greater. Open the high side bleed valve to drop the pressure to 0.0 psi and observe whether the air inlet is fully open. Close the high side bleed valve, the vent valve and the bleed valve attached to the test cock if it were opened to compensate for a shutoff valve leak. NOTE: If the shutoff valve leak cannot be compensated for using the bleed valve attached to the test cock, the shutoff valve must be repaired or replaced.
 - g. Open No. 1 shutoff valve slowly, to reestablish pressure.
-

Test Procedure - Part B

Check Valve Closing Point

Purpose: To determine the static pressure drop across the check valve.

Requirement: The check valve must hold at least 1.0 psi in the direction of flow when the downstream side is at atmospheric pressure.

Procedure: **Refer to Figure 8**

- a. Close No. 1 shutoff valve (No 2 shutoff valve should already be closed). Check for shutoff valve leak by bleeding the bleed valve attached to test cock so the gauge drops and stabilizes at 8-10 psi.
 - b. Open the vent valve to drain the water from the body. When flow stops, record the gauge reading as the static pressure drop across the check valve. The gauge reading must be 1.0 psi or greater. Record this value for check valve No. 1.
 - c. If water continues to leak out of the vent valve because of a No.1 shutoff valve leak, slowly open the bleed valve attached to the test cock until the water flow from the vent valve slows to a slight drip. Record the gauge reading as the static pressure drop across the check valve. If the leak across the No. 1 shutoff valve cannot be compensated for using the bleed valve attached to the test cock, the shutoff valve must be repaired or replaced.
 - d. Close vent valve and test cock, remove equipment, open No. 1 shutoff valve, then No. 2 shutoff valve and replace air inlet canopy.
-

TWO CHECK PRESSURE TYPE VACUUM BREAKER GAUGE TEST PROCEDURE

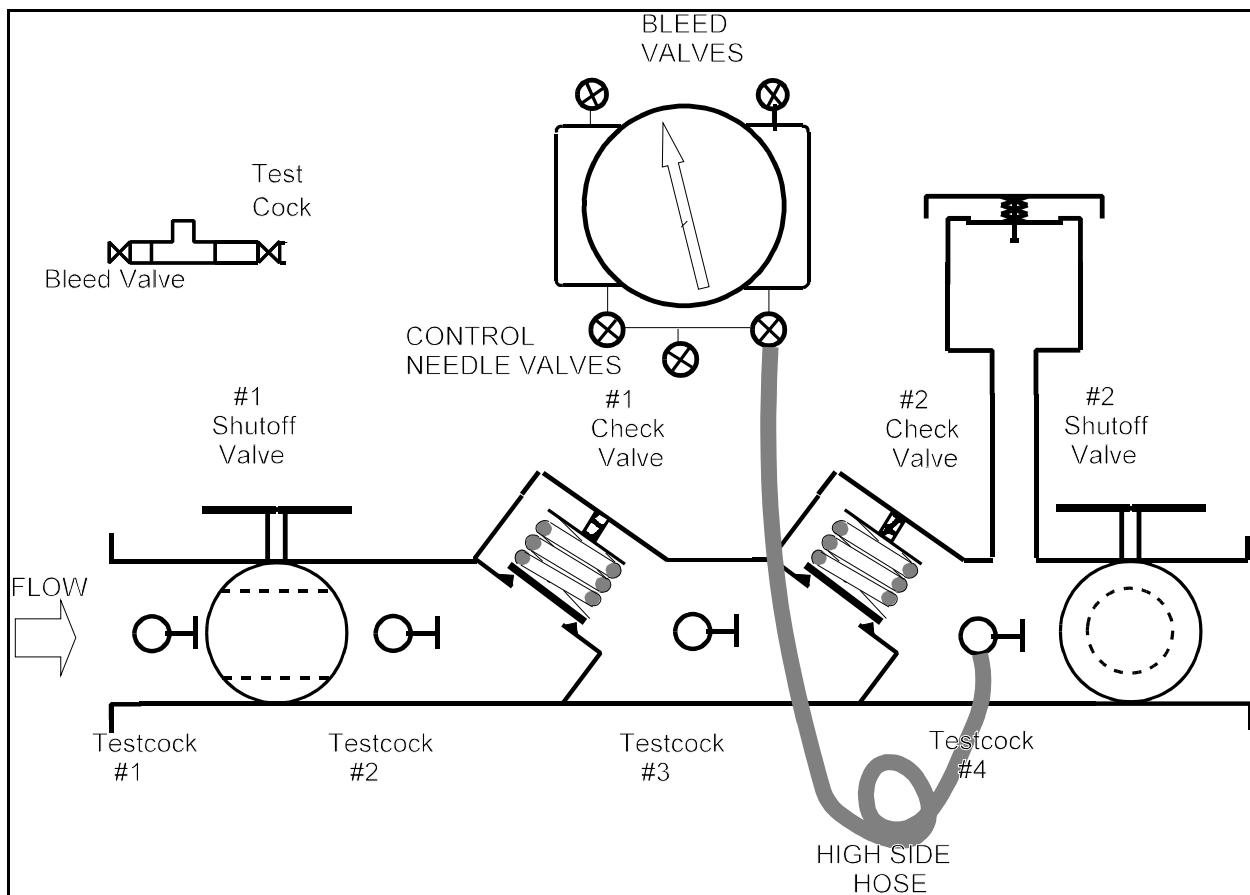


Figure 9
Gauge connection for air inlet test.

Test Procedure - Part A: Air Inlet Operation

Purpose: To obtain the opening pressure differential of the air inlet valve.

Requirement: The air inlet valve must open when the water pressure in the body is at least 1.0 psi above atmospheric pressure, and the air inlet valve must be fully open with water drained from body.

Procedure: **Testing air inlet (refer to figure # 9)**

- a. Remove cover over air inlet. This will permit observation of the air inlet valve and allow location of air inlet seat to obtain point of measurement.
- b. Attach high pressure side hose of gauge with bleed valve (closed) at test cock #4.
- c. Open test cock #4, and vent air from hose and gauge.
- d. Close shutoff valve #2, then valve #1. Slowly open bleed valve, holding gauge at level of air inlet seat. Obtain pressure reading of gauge at moment air inlet opens. If reading is 1.0 psi or above, enter number on report form. If less than 1.0 psi, air inlet valve is defective, and is so noted on report form.
- e. Close test cock #4, remove gauge hose and replace air inlet cover.

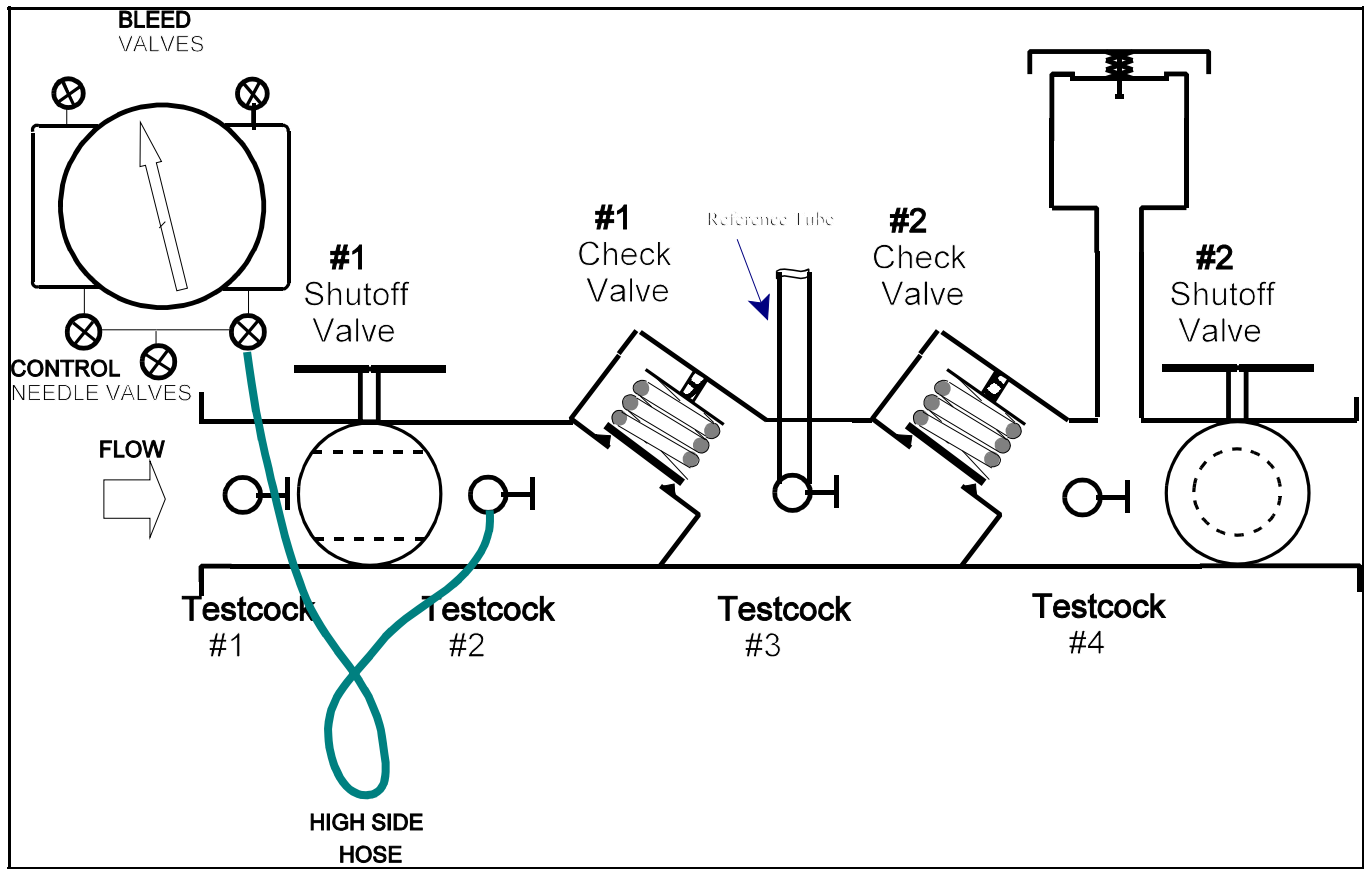


Figure 10
Gauge connection for check valve testing w/ reference tube

Test Procedure - Part B: Check Valve Operation

Purpose: To test check valves for tightness in direction of normal flow.

Requirement: The check valve shall not allow water flow in normal direction when the water pressure is 1.0 psi and the outlet pressure is atmospheric.

Procedure: **Testing check valve #1 (Refer to Figure 10)**

- Attach high pressure side hose of gauge and bleed valve (closed) to test cock #2.
- Open test cock #2. Open shutoff valve #1, vent air from hose and gauge, then close.
- Open test cock #3, holding gauge at level of the reference tube. Note: If the outlet of test cock #3 is at the top of the valve body, hold the gauge at the level of the test cock outlet. Check for shutoff valve leak by observing whether water continues to overflow the reference tube on #3 test cock and compensate with bleed valve.
- Obtain reading of gauge. If 1.0 psi or above note the gauge reading on the report. If less than 1.0 psi check valve is noted as "leaked."
- Close test cocks #2 and #3.

Testing check valve #2

- a. Move high pressure side hose of gauge and bleed valve (closed) to test cock #3.
 - b. Open test cock #3. Open shutoff valve #1 enough to vent air from hose and gauge, then close.
 - c. Open test cock #4. Holding gauge at level of the top of the reference tube (see Note above, also). Check for shutoff valve leak by observing whether water continues to overflow the reference tube on #4 test cock and compensate with bleed valve. Evaluate and report test as in step d, above.
 - d. Close test cocks #3 and #4, remove gauge hose and fittings and open shutoff valves.
-

DOUBLE CHECK VALVE BACKFLOW PREVENTION ASSEMBLY GAUGE TEST PROCEDURE

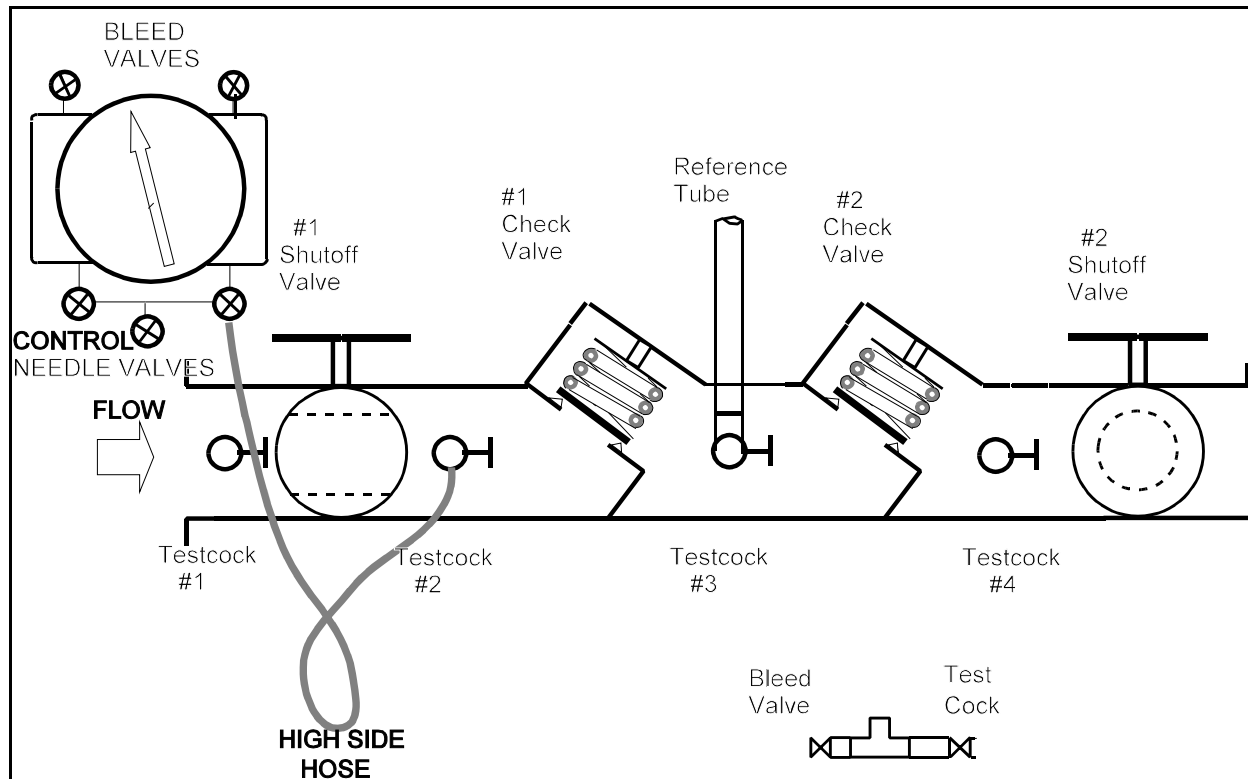


Figure 12
Gauge connection for check valve test w/ reference tube

Test Procedure - Part A: Check Valve #1 Operation

Purpose: To test check valve for tightness in direction of normal flow.

Requirement: The check valve shall not allow water flow in normal direction when the water pressure is 1.0 psi and the outlet pressure is at atmospheric.

Procedure: **Testing check valve #1 (Refer to Figure 11)**

- Attach high pressure side hose of gauge and bleed valve (closed) to test cock #2.
- Open test cock #2 and vent air from hose and gauge, then close. Open test cock #3 to fill reference tube.
- Close shutoff valve #2, then #1.
- Open test cock #3 slowly, holding gauge at level of the top of the reference tube on test cock #3.
Note: If the outlet of test cock #3 is at the top of the valve body, hold the gauge at the level of the test cock outlet. Check for shutoff valve leak by observing whether water continues to overflow the reference tube on #3 test cock and compensate with bleed valve.
- Obtain reading of gauge. If 1.0 psi or above note the gauge reading on the report. If less than 1.0 psi check valve is noted as "leaked."
- Close test cocks #2 and #3.

Check Valve #2 Operation

The purpose and the requirement are the same as for Part A.

Procedure: Testing check valve #2

- a. Move high pressure side hose of gauge and bleed valve (closed) to test cock #3 and reference tube to test cock #4.
 - b. Open test cock #4 to fill reference tube. Open test cock #3. Open shutoff valve #1 enough to vent air from hose and gauge, then close.
 - c. Open test cock #4 slowly, holding gauge at level of the top of the reference tube on check valve #4 (see Note above). Check for shutoff valve leak by observing whether water continues to overflow the reference tube on #4 test cock and compensate with bleed valve. Evaluate and report test as in step d, above.
 - d. Close test cocks #3 and #4, remove gauge hose and fittings then open shutoff valves #1 and #2.
-

REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY GAUGE TEST PROCEDURE

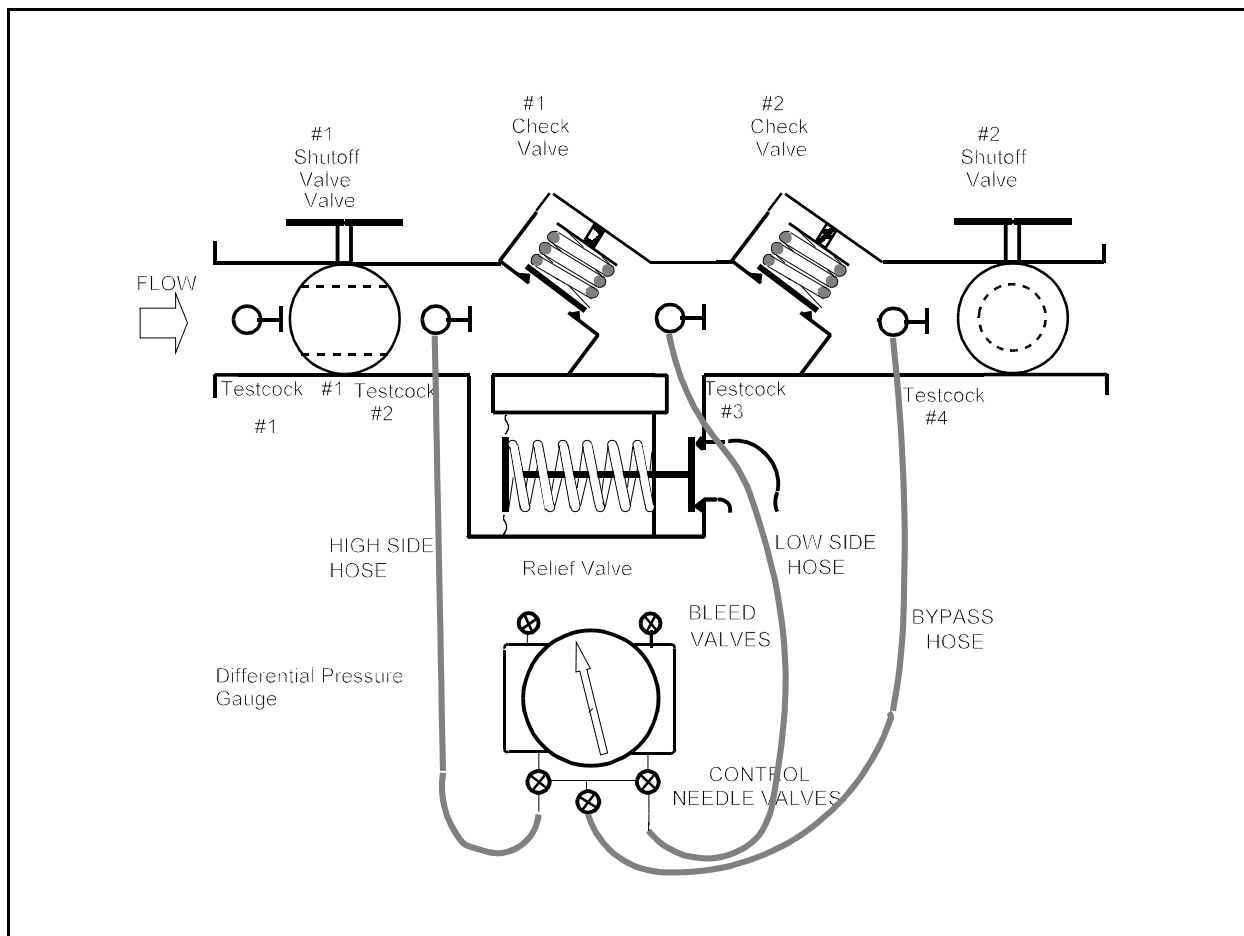


Figure 13
Differential gauge connection to RP assembly.

Test Procedure - Part A: Check Valve #1 Operation (apparent)

Purpose: To test No. 1 check valve for tightness against reverse flow and to **note** the **apparent** static pressure drop across the check valve (this reading would be the static pressure drop across the check valve providing there is no flow through the assembly).

Requirement: Valve must be tight against reverse flow under all pressure differentials. The static pressure drop across the check valve should be at least 3.0 psi greater than the relief valve opening recorded in Test Procedure – Part B.

Procedure: **Testing check Valve #1 (refer to Figure 12)**

- a. Close #2 shutoff valve.
- b. Connect high pressure gauge lead to test cock #2; low pressure gauge lead to test cock #3 and bypass hose to test cock #4.
- d. Open test cocks #3 then #2 and vent air from hoses and gauge by opening the low bleed then the high while the low bleed is left open. Close the high bleed then the low.
- e. **Note** the **apparent** pressure differential across the first check valve. If the differential pressure relief valve is operating on reduced pressure and there is no drainage from it with the #2 gate valve closed, the #1 check valve **can only be assumed** as closed tight until no flow through can

be determined. If there is drainage from the differential pressure relief valve the check shall be noted as leaked.

Test Procedure - Part B: Relief Valve Operation

Purpose: To test operation of differential pressure relief valve.

Requirement: The differential pressure relief valve must operate to maintain the zone between the two check valves at least 2.0 psi less than the supply pressure.

Procedure: **Testing Relief Valve Opening (Refer to Figure 12)**

- a. Open needle control valve on the high side of the gauge manifold several turns and open the needle control valve on the low side slowly ¼ turn to bypass water and note the reading on the gauge at initial opening of the differential relief valve. Enter pressure differential in psi on test report. NOTE: Needle should drop steadily by itself until relief valve opens. If further turns of control valve are necessary #2 shutoff valve is probably leaking and may require repair.

Test Procedure - Part C: #2 Check Valve Operation

Purpose: To test #2 check valve for tightness against reverse flow.

Requirement: Valve must be tight against reverse flow under all pressure differentials.

Procedure: **Testing check valve #2 (Refer to Figure 12).**

- a. Connect bypass hose to test cock #4.
- b. Open low side bleed valve on the gauge to reestablish the differential on the gauge then close bleed valve.
- c. Open test cock #4 and slowly open the bypass needle control valve while watching the gauge. If the gauge is dropping and water starts discharging from the differential pressure relief valve, the check valve may be leaking but there is also a possibility of 2nd check disc compression or 2nd check movement that caused the relief valve to discharge. Before noting the check valve "leaking," the tester should bleed the low side of the gauge to relieve any disc compression and thus confirm the check valve leaking if the gauge drops and the relief valve discharges. If no water is discharged the check valve shall be noted as "closed tight" and so checked on the report.

Test Procedure - Part D: Check Valve #1 Operation (static)

Purpose: To test No. 1 check valve for tightness and to **record** the static pressure drop across the check valve.

Requirement: The static pressure drop across the check valve should be at least 3 psi greater than the relief valve opening recorded in test No. 2. The 3 psi buffer is a manufacturer's specification that would not automatically fail a device providing the check valve is holding tight.

Procedure: **Testing check Valve #1 (refer to Figure 12)**

- a. With the bypass hose still connected to test cock #4, bleed water from the low side bleed on the gauge until the gauge exceeds the apparent #1 check valve pressure drop in step A. Close the low side bleed on the gauge and let the gauge settle.
 - b. Note the pressure differential across the first check valve. If the differential pressure relief valve is operating on reduced pressure, the gauge is not falling and there is no drainage from it with the #2 gate valve closed, the #1 check valve shall be noted as closed tight and the differential gauge reading **recorded** on the report. If there is drainage from the differential pressure relief valve the check shall be noted as leaked.
 - c. Open shut-off valve #2, close all test cocks and remove all test equipment.
-

**REDUCED PRESSURE PRINCIPLE DETECTOR BACKFLOW PREVENTION ASSEMBLY
GAUGE TEST PROCEDURE****Test Procedure - Part A: Testing Main Line Assembly**

Purpose: To test the operation of the main-line reduced pressure principle backflow prevention assembly.

Requirement: The main-line reduced pressure principle backflow prevention assembly shall comply with field test requirements of the reduced pressure principle backflow assembly (see Page 27).

Procedure:

- a. Close #2 shutoff valve of bypass assembly.
- b. Perform testing procedures on main-line assembly.
- c. Leave #2 shutoff valve on main-line assembly closed.

Test Procedure - Part B: Testing Bypass Assembly

Purpose: To test the operation of the bypass reduced pressure principle backflow prevention assembly.

Requirement: The bypass reduced pressure principle backflow prevention assembly shall comply with field test requirements of the reduced pressure principle backflow assembly (see Page 27).

Procedure:

- a. Perform testing procedures on bypass assembly.
 - b. Open all shutoff valves on RPDA.
-

**DOUBLE CHECK DETECTOR BACKFLOW PREVENTION ASSEMBLY
GAUGE TEST PROCEDURE****Test Procedure - Part A: Testing Bypass Assembly**

Purpose: To test the operation of the bypass double check valve backflow prevention assembly.

Requirement: The bypass double check valve backflow prevention assembly shall comply with field test requirements of the double check valve backflow assembly (see Page 25).

Procedure:

- a. Perform testing procedures on bypass double check valve assembly.
- b. Leave both shutoff valves on bypass assembly closed.

Test Procedure - Part B: Testing Main-Line Assembly

Purpose: To test the operation of the main-line double check valve backflow prevention assembly.

Requirement: The main-line double check valve backflow prevention assembly shall comply with field test requirements of the double check valve backflow prevention assembly (see Page 25).

Procedure:

- a. Perform testing procedures on main-line double check valve assembly.
 - b. Open all shutoff valves on DCDA.
-

Understanding mechanical problems that occur with backflow prevention devices is a must for any competent backflow prevention device tester. Diagnosing and then troubleshooting the various problems is typical while working with these devices. The following are some of the problems that backflow prevention device testers are expected to know, understand, troubleshoot and document properly on the test notices:

RP's:

- Leaking First Check
- Leaking Second Check
- Leaking # 1 Shut-off Valve
- Leaking # 2 Shut-off Valve
- Stuck Relief Valve, either in the opened or closed position
- Blocked Sensing Line
- Flow Thru Condition

DC's:

- Bad First Check
- Bad Second Check
- Bad # 1 Shut-off Valve
- Bad # 2 Shut-off Valve

PVB's

- Bad First Check
- Bad # 1 Shut-off Valve
- Bad # 2 Shut-off Valve

SVB

- Bad First Check
- Bad # 1 Shut-off Valve
- Bad # 2 Shut-off Valve

Gauge

- Out of Calibration
- Shut off valves/needle valves leaking

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